MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2016/2017

BMT1014 – MANAGERIAL MATHEMATICS

(All sections / Groups)

22 OCTOBER 2016
2.30 p.m – 4.30 p.m
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of **6 pages** including cover page and Mathematical formulas with **4 Questions** only.

2. Attempt **ALL** questions and write your answers in the Answer Booklet provided.

Question 1 (25 marks)

Reddy Mikks produces both interior and exterior paints from two raw materials, *M1* and *M2*. The following table provides the basic data of the problem:

	Tons of raw material per ton of		
	Exterior paint	Interior paint	Maximum daily availability (tons)
Raw material, *M1*	6	4	24
Raw material, *M2*	1	2	6
Profit per ton ($1000)	5	4	

A market survey indicates that the daily demand for interior paint cannot exceed that of exterior paint by more than 1 ton. Also, the maximum daily demand of interior paint is 2 tons. Reddy Mikks wants to determine the optimum (best) product mix of interior and exterior paints that maximizes the total daily profit.

a) Formulate a linear programming model for this problem. **[8 marks]**

b) Solve the LP problem graphically and state the optimal solution. **[17 marks]**

Question 2 (25 marks)

a) Find the point of intersection of the straight lines that have equations $y = x + 1$ and $y = -2x + 4$ **[4 marks]**

b) Dexter Landscape Design wants to build a $250,000 greenhouse in 3 years. The company sets up a sinking fund with payments made quarterly. Find the payment into this fund if the money earns 5% compounded quarterly. **[5 marks]**

c) Maya bought a car with a down payment of $3000 and payments of $500 per month for 7 years. If the interest rate is 4% compounded monthly, what is the total cost of the car? **[5 marks]**

d) In order to purchase a house, Nelly borrows $250,000 at 3.6% for 25 years. What is her monthly payment? **[5 marks]**

Continued...

e) If Mikael have \$50,000 to invest for 18 months with two options:

i. Invest the money in a certificate paying interest at the nominal rate of 5% compounded quarterly;

ii. Invest the money in a saving account earning interest at the annual rate of 4.5% compounded continuously.

How much money will he have in 18 months with each option?

[6 marks]

Question 3 (25 marks)

a) Differentiate the following functions:

i. $f(x) = x^3(\sqrt{x}+1)$ **[3 marks]**

ii. $y = \dfrac{\sqrt{2x+1}}{x^2-1}$ **[5 marks]**

b) Evaluate the given partial derivatives;

$$g(x,y) = 4x^2 + x\ln(y^2+1) - 7y;\ g_y(1,2)$$

[4 marks]

c) Suppose the relationship between the unit price p in dollars and the quantity demanded x of the Acromonic model F loudspeaker system is given by the equation,

$$p = -0.006x + 180$$

and the cost function is,

$$C(x) = 0.002x^2 + 120x + 60,000$$

i. Find the value of x that maximizes the profit. **[5 marks]**

ii. Determine the total profit for level of production in (i). **[3 marks]**

iii. Under certain condition, the government has imposed an excise tax of \$10 per unit. Find the value of x that maximizes the profit after the excise tax.

[5 marks]

Continued...

Question 4 (25 marks)

a) Find each of the following:

i. $\int 3x^2\left(x^3+2\right)^{3/2}dx$ **[5 marks]**

ii. $\int_0^2 x^2(x^3+1)^{3/2}dx$ **[5 marks]**

b) The current circulation of the Investor's Digest is 3142 copies per year. The managing editor of this weekly projects a growth rate of

$$C'(t) = 12.288t^2 - 150.5594t + 695.23$$

Dollar per year, where t is measured in 5-year intervals with $t = 0$ corresponding to year 1995.

i. Find the function for out-of-pocket costs for beneficiaries in year t.

[6 marks]

ii. On the basis projection, what will be the circulation of the digest in year 2000 and 2010? **[4 marks]**

c) Find the area of the region R bounded by the graphs of the following functions:

$$f(x) = x^2 - 2x - 1 \quad \& \quad g(x) = -e^x - 1$$

where $f(x)$ is the top curve and $g(x)$ is the below curve between the vertical lines $x = -2$ and $x = 2$. **[5 marks]**

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Course : Managerial Mathematics
Code : BMT 1014

Summary of Principal Formulas and Terms

Simple Interest

(i) Interest, $I = Prt$ (P = principal, r = interest rate, t = number of years)
(ii) Accumulated amount, $A = P(1 + rt)$

Compound Interest

(i) Accumulated amount, $A = P(1+i)^n$, where $i = \frac{r}{m}$, and $n = mt$
(m = number of conversion periods per year)

(ii) Present value for compound interest, $P = A(1+i)^{-n}$

Effective Rate of Interest

$$r_{eff} = \left[1+\frac{r}{m}\right]^m - 1$$

Future Value of an Annuity

$$S = R\left[\frac{(1+i)^n - 1}{i}\right]$$ (S = future value of ordinary annuity of n payments of R dollars periodic payment)

Present Value of an Annuity

$$P = R\left[\frac{1-(1+i)^{-n}}{i}\right]$$ (P = present value of ordinary annuity of n payments of R dollars periodic payment)

Amortization Formula

$$R = \frac{Pi}{1-(1+i)^{-n}}$$ (R = periodic payment on a loan of P dollars to be amortized over n periods)

Sinking Fund Formula

$$R = \frac{Si}{(1+i)^n - 1}$$ (R = periodic payment required to accumulate S dollars over n periods)

Basic Rules of Differentiation

(a) Chain rule: Derive $g[f(x)] = g'[f(x)]f'(x)$
(b) General power rule: Derive $[f(x)]^n = n[f(x)]^{n-1} f'(x)$
(c) Exponential function: Derive $e^x = e^x$

(d) Derive $\left(e^{u}\right)=e^{u}\left[u'(x)\right]$ Logarithmic function: Derive $\ln x=\frac{1}{x}$

Derive $\left(\ln u(x)\right)=\left(\frac{1}{u(x)}\right)\left[u'(x)\right]$

Basic Rules of Integration

(a) Exponential function: $\int e^{u}\,du=e^{u}+C$

(b) Logarithmic function: $\int\left(\frac{1}{u}\right)du=\ln u+C$

Determining Relative Extrema

$$D(x,y)=f_{xx}f_{yy}-\left(f_{xy}\right)^{2}$$

If D > 0 and $f_{xx} > 0$, relative minimum point occurs at (x, y).
If D > 0 and $f_{xx} < 0$, relative maximum point occurs at (x, y).
If D < 0, (x, y) is neither maximum nor minimum.
If D = 0, the test is inconclusive.